

Nitrogen in Micropores at High Pressure; Determination of Phase Transitions Using Raman Spectroscopy

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The phase behavior of nitrogen in micropores has been studied by x-ray measurements under its own vapor pressure by Huber et al. [1]. It turns out that the high temperature β -phase is stable down to the lowest temperature investigated (16 K) while in bulk nitrogen it transforms to the α -phase at 35 K.

At high pressures nitrogen shows several solid phases. At about 4.5 GPa the β -phase transforms in bulk nitrogen to the δ -phase at room temperature. This makes it possible to study very large shifts in the phase transition temperature. The δ -phase is of particular interest because there are two different sites resulting into two vibrational frequencies and two types of orientational behavior. Within the δ -phase a second order transition occurs [2].

We have performed high pressure measurements in a diamond anvil cell on the vibrational spectrum of nitrogen using Raman spectroscopy. The influence of the pore size has been investigated by carrying out measurements on pores of 17 and 62 Å. The data have been collected as a function of pressure at room temperature and along a quasi-isobar at 4.3 GPa from 140 to 320 K. One of the difficulties is the distinction between the spectra from the bulk nitrogen, the nitrogen adsorbed on the outside of the pore walls and the nitrogen inside the pores.

There is a considerable effect on the phase transition lines. This effect is dependent on the phase transition line and on the pore size. The spectra become more complex since the existence of two coexisting phases in the sample space in a large temperature interval has been detected. The results will be discussed.

- [1] P. Huber, D. Wallacher, and K. Knorr, in press.
- [2] M.I.M. Scheerboom and J.A. Schouten, *Phys. Rev. Lett.* **71** 2252 (1993).